Oral appliance treatment for obstructive sleep apnea in a partly edentulous patient

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Introduction: We report on the use of an oral appliance fitted to a few maxillary and mandibular teeth to treat obstructive sleep apnea syndrome. **Methods:** We used a mandibular repositioning appliance, the adjustable PMPositioner. Polysomnograms were taken before and after use of the appliance. **Results:** The apnea-hypopnea index decreased from 19.0 to 8.0. Minimum oxygen saturation increased from 80.0% to 86.0%, and rapid eye movement sleep increased from 6.0% to 20.0%, indicating that the device remained in position during sleep. A 2-year follow-up showed that periodontal and gingival health was maintained. **Conclusions:** Oral appliances such as the PMPositioner are an alternative for treating obstructive sleep apnea in partly edentulous patients. (Am J Orthod Dentofacial Orthop 2010;137:548-51)

Obstructive sleep apnea (OSA) is a public health problem and a potentially life-threatening condition[1]; it is characterized by the repeated collapse or narrowing of the pharyngeal walls during sleep, interrupting normal sleep.[2] The appearance and progress of certain diseases, such as hypertension, cardiovascular disorders, brain stroke, sexual dysfunction, cognitive deficits, and others, can be related to breathing disorders during sleep.[3] The physiopathology and etiology of OSA are not yet fully understood, but certainly an interaction between anatomic and neuromuscular alterations seems to determine the collapse of the pharynx.[4,5] The impact of OSA on a patient's life is sometimes irreversible; snoring affects the sleep of the bed partner, and interrupted sleep at night can cause problems during the day, including sleepiness, loss of concentration, memory malfunction, and impaired performance of common skills such as driving. These factors add up to a decrease in quality of life; if not reversed, OSA can affect the person's life span.[6]

Because OSA is a problem of the airway, odontology might be important in treatment. The airway can be changed by shifting the mandible forward with an oral appliance, increasing the airway volume.[7] Oral appliances have proven to be effective, comfortable, and noninvasive, as well as relatively easy to manufacture.[7] Today, among many kinds of oral appliances, mandibular repositioning appliances, especially adjustable models, are widely used in dental sleep practice. The other options for OSA patients are the continuous positive airway pressure (CPAP) device and surgery.[8,9] Patients prefer oral appliances and mandibular repositioning appliances, even knowing that the CPAP might have a better result.[5] Mandibular repositioning appliances are not indicated when the patient has fewer than 8 teeth in each arch.[10-12]

The purpose of this article was to report our experience in using an adjustable mandibular repositioning appliance for a partly edentulous patient. The goal was to decrease the apnea-hypopnea index (AHI), increase minimum oxygen saturation (SaO2 nadir), increase rapid eye movement (REM) sleep, and eliminate or reduce snoring and subjective symptoms. Because mandibular repositioning appliances work with the patient's dentition, edentulous or partly edentulous patients do not usually qualify for this treatment. However, it can be considered for partly edentulous patients who refuse CPAP therapy and surgery.

CASE REPORT

The patient was a 74-year-old man with a body mass index of 28kg per square meter and no cardiovascular disease. He was referred by a sleep disorder specialist

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Table. PSG values before treatment and with the PMPositioner in place

PSG measurement	*Pretreatment*	*With oral appliance*	*With oral applicance at 2-year follow-up*
AHI	19.0	8.0	8.4
Apnea	10.0	4.0	3.0
Hypopnea	9.0	4.0	5.2
SaO2 nadir	80.0%	86.0%	85.6%
REM	6.0%	20.0%	19.4%

for treatment with an oral appliance. The basal polysomnogram (PSG) findings showed an AHI of 19.0 per hour, SaO2 nadir of 80.0%, and a REM sleep of 6.0% (Table). The patient's medical history was covered in the initial consultation. He reported snoring, nocturnal breathing arrests, tiredness upon awakening, and difficulty in concentrating. The temporomandibular joint examination showed no signs or symptoms that would contraindicate oral appliance treatment. His wife reported that her sleep was affected because she was afraid her husband could die during his sleep. The patient had 7 teeth in the mandible and 6 in the maxilla, all without mobility and with periodontal bags and tartar; he wore partial maxillary and mandibular prostheses (Fig 1). The first option for this patient was a CPAP device, but he had refused it and wanted to try oral appliance therapy first. Because we have used the adjustable PMPositioner (EUA, São Paulo, Brazil) in many other patients, albeit generally those with most of their teeth, we chose to try it with this patient. The appliance is fabricated in 2 parts that are joined together by expanders on each side; this setup allows for individualized titration. To improve retention, special clasps are included (Fig 2). A constructive wax bite was made at approximately 60% of maximum protrusion and was sent along with the dental cast models to a specialized laboratory where the appliance would be fabricated. The increase in the vertical dimension including the measurement of overbite did not exceed 9 mm, providing good appliance adaptation and comforable effectiveness.

The appliance was placed (Fig 3), and the patient was advised about care and hygiene. He was to return for follow-up visits every 6 months for the first year and at least annually thereafter. He was also advised to have his teeth professionally cleaned every 6 months to ensure periodontal and gingival health.

Fifteen days after placement of the appliance, the initial titration was 1 mm. Subsequent titrations of 0.25 mm were done weekly to prevent temporomandibular joint and lateral pterygoid muscle pain. The forward amount was based on reports by the patient and his wife about the reduction in snoring and apnea. The total advancement was 8 mm and took about 2 months to complete. Six months after the last titration, a PSG was performed with the mandibular repositioning appliance in place. The patient returned regularly for his scheduled appointments. Two years after the appliance was placed, another PSG was taken.

RESULTS

A comparison of the PSGs taken before and 6 months after the start of mandibular repositioning appliance therapy (with the appliance in place) showed that the AHI was reduced from 19.0 per hour to 8.0 per hour, the SaO2 nadir increased from 80.0% to 86.0%, and REM sleep increased from 6.0% to 20.0%; his wife reported that snoring was significantly reduced. Although the mandibular repositioning appliance was attached to only a few teeth, it did not displace during sleep.

The 2-year follow-up showed that periodontal and gingival health was maintained (Fig 4). The patient had no dental mobility or periodontal bags at the oral examination and also no signs or symptoms of temporomandibular dysfunction using the oral appliance 6 days per week.

DISCUSSION

The patient reported a great relief of symptoms after the second week of using the PMPositioner. Clinicians need not categorically exclude partly or totally edentulous patients from oral appliance therapy. The few available articles concerning edentulism and oral appliances did not report performing a PSG with the appliance in place, and the relief of symptoms was based only on the patients' reports.[12,13] Among the few reports of edentulous patients using oral appliances, no article was found describing the adaptation of the oral appliance on a few maxillary and mandibular teeth; articles reported, instead, its adaptation on the mucosa or through the use of a tongue retainer appliance. Tongue retainer appliance is more indicated for edentulous or partly edentulous patients because it is custom-made, with a front suction bubble, which uses negative pressure to push the tongue tip to a more frontal position, thus enhancing the airway diameter.[10] Barthlen et al[14] used a tongue retainer appliance in their study and reported no improvement of the AHI. Moreover, most of their patients complained of pain and burning on the tongue from the suction caused by this appliance.

The mandibular repositioning appliance, on the other hand, is indicated for dentate patients because of its better fit and better approach to the dental

Fig 1. Pretreatment intraoral photographs of a partially edentulous patient, without and with his partial prostheses.

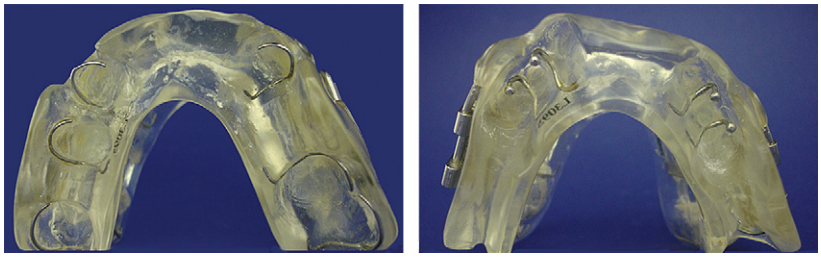

Fig 2. Mandibular repositioning appliance, occlusal views.

Fig 3. Frontal view of mandibular repositioning appliance.

Fig 4. Two-year posttreatment photos show periodontal and ginvigal health had not deteriorated.

structure.[10] Otsuka et al[15] compared only oxyhemoglobin saturation with and without the appliance and reported significant improvements in SaO2 and blood pressure with the appliance in place. Coruzzi et al[16] found that oral appliance therapy improves cardiac-autonomic modulation. Comparing the use of an oral appliance and CPAP, Tan et al[8] also obtained fairly good results in terms of increased SaO2 with an oral appliance. According to Clark,[17] a contraindications for the use of an oral appliance is the absence of or few dental elements. In our partly edentulous patient, the PMPositioner fitted to the few maxillary and mandible teeth produced excellent results in terms of the AHI, which dropped from an initial 19.0 to 8.0 per hour. Snoring was not measured during the PSG, but, according to his spouse, it reduced significantly, and the SaO2 nadir and REM sleep rose substantially. The patient made no complaints, although in most cases complaints are normally expected at the beginning of treatment. It is a consensus that oral appliances can decrease the severity of OSA by advancing the mandible and increasing the diameter of the upper airway, but the evidence relating to the effect of adjustable mandibular repositioning appliances on upper airway dilatory muscle activity is an inadequately evaluated topic. In a previous study, Johal et al[5] found that highly significant increases in the electromyography activity of the genioglossus, geniohyoid, and masseter muscles acompanied the placement of mandibular repositioning appliances in awake OSA patients. Their findings propose the possibility of a physiologic role to the established anatomic effect of increasing the size of the pharyngeal airway. In other words, the increase of upper airway morphology might be 1 mechanism by which a mandibular repositioning appliance improves OSA.[18]

CONCLUSIONS

An adjustable mandibular repositioning appliance fitted to a few maxillary and mandible teeth proved effective in reducing the AHI and snoring, and increasing the SaO2 nadir and REM sleep during sleep. Partly edentulous patients who refuse surgery or CPAP therapy can be candidates for oral appliance therapy. At the 2-year follow-up, no additional damage to dental and periodontal health was seen.

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